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New perspectives for methane production from oleate: bioaugmentation of anaerobic sludge with *Syntrophomonas zehnderi*

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Biogas production from waste lipids is a promising technology for sustainable energy production. In anaerobic bioreactors, lipids and long-chain fatty acids (LCFA) are easily removed from the liquid medium, mainly by adsorption. However, further LCFA degradation is rate-limiting and possible dependent on the development of syntrophic communities. Denaturing gradient gel electrophoresis (DGGE) of PCR-amplified 16S rRNA genes was used to follow the changes in bacterial communities during continuous and fed-batch reactors operation with oleate, an unsaturated LCFA. A specific dominant DGGE-band corresponding to bacteria deeply clustering with *Syntrophomonas zehnderi* (99% identity) was found in all the sludges that could degrade oleate, thus suggesting the involvement of this bacterium in unsaturated LCFA catabolism. Therefore, the potential of *S. zehnderi* as bioaugmenting strain for improving methane production from oleate was further studied in batch assays. Oleate was added to the medium at a final concentration of 1 mM and the assays were performed with and without the solid microcarrier sepiolite. Methane production was faster in the bioaugmented assays, and this effect was more pronounced in the presence of sepiolite. The positive effects of sepiolite can be related to a decrease in oleate toxicity towards the acetoclastic methanogens, or to an improvement of the syntrophic relationships. Bioaugmentation with *S. zehnderi* might be a suitable strategy for accelerating LCFA conversion to methane in anaerobic bioreactors, shortening the start-up period of high rate continuous processes or recover LCFA-inhibited sludges.

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